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Astragalus tijuanensis and *Astragalus brauntonii* var. *lativexillum*, a new species and a new variety in the genus *Astragalus* (Fabaceae) from extreme northwestern Baja California, Mexico

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Abstract

We describe and illustrate *Astragalus tijuanensis*, morphologically related to *Astragalus palmeri*, and *Astragalus brauntonii* var. *lativexillum* as a new species and a new variety respectively from extreme northwestern Baja California, Mexico. Both new taxa were discovered growing on specialized clay soils in a recently burned chaparral habitat, both taxa are extremely rare and threatened.

Keywords: Leguminosae, Northwestern Mexico, section *Inflati*, section *Brauntoniani*

Resumen

Se describen e ilustran *Astragalus tijuanensis* relacionada morfológicamente con *Astragalus palmeri* y *Astragalus brauntonii* var. *lativexillum* como una nueva especie y una nueva variedad respectivamente del extremo noroeste de Baja California, México. Ambos taxa nuevos fueron descubiertos creciendo en suelos arcillososo especializados, en hábitat de chaparral recientemente incendiado, ambos taxa son extremadamente raros y amenazados.

Palabrasclave: Leguminosae, Noroeste de México, sección *Inflati*, sección *Brauntoniani*

Introduction

As part of an ongoing research project entitled "*Astragalus* of Mexico", we continue to study and examine members of this diverse genus throughout Mexico. The peninsula of Baja California and its adjacent islands have a very rich flora consisting of 186 families, 1,093 genera and 3551 species of vascular plants, with almost 26% of its native flora being endemic (Rebman *et al.*, 2016). Among the most diversified plant families are Asteraceae, Fabaceae, and Poaceae. In respect to the Fabaceae, the genus *Astragalus* L. (1753: 755) is the most diverse genus within Fabaceae (Barneby 1989) and among flowering plants (Lock & Simpson 1991, Zarre & Azani 2013) including 2,300 (Lock & Schrire 2005) to 2,500 (Lewis *et al.* 2005), or even 2,900 species (Zarre & Azani 2013). Its distribution is more abundant in temperate regions of the Northern Hemisphere, especially in central and western Asia, including 2500 species of *Astragalus* in the Old World (Lnag-rang & Podlech 2010), Turkey, Iran, and Afghanistan (1500 species), central Asia, Europe, (approx. 620 species), North America with 401 species (221 endemic) in 59 sections (Lnag-rang & Podlech 2010), is well represented in almost all main plant communities in the peninsula of Baja California, as reported by Barneby (1964), inhabiting arid shrubland associations in the lowlands to oak–pine and conifer forest in the high elevation mountains.

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The genus is represented by 30 species and 39 infraspecific taxa, of which 54% (21 taxa) are endemic to the peninsula (Rebman *et al*., 2016); Estrada *et al*., 2019). Of the 93 sections and 370 species in which the genus is subdivided in North America (Barneby 1964), almost 100 species included within 20 of these sections are found in Mexico (Barneby 1964; Estrada *et al.*, 2020; Estrada *et al.*, 2022),) and 13 of the sections and of the 29 species are found in the Baja California region (Rebman *et al.* 2016. The most diversified in number of species is the sect. *Inflati* A. Gray (1864: 213) accounting for 18 species, and 15 of these are present in the peninsula. Among the most distinctive morphological characteristics of this section are: a superficial root crown or a forking caudex, simple pubescence, free stipules, 5–35 leaflets per leaf, flowers relatively small, the banner 16 mm or shorter, calyx tube campanulate, petal graduated, pod sessile on the receptacle or elevated by a gynophore and disjointing when ripe, mature fruit usually inflated like a bladder or only scarcely turgid, valves papery o papery–membranous, and absent septum (Barneby 1964), the new species belongs to this section and is more similar to *Astragalus palmeri* A. Gray (1868: 398). The sect. *Brauntoniani* (Rydb.) Barneby (1964: 1119) with a single species, *Astragalus brauntonii* Parish (1903: 26) has a highly restricted distribution in Los Angeles County and a few adjacent areas in the state of California. This section is recognized for some particular morphological features, among which the following stand out: relatively large and perennial habit, villose to tomentulose pubescence, stipules free, flowers 35–60 per inflorescence, petals purple, marcescent, banner 9–12 mm long, pod completely bilocular, up to 9 mm long, sessile and deciduous, scarcely exserted from calyx, and 6–9 ovules (Barneby 1964). Recent botanical collections from northern Baja California include two specimens of *Astragalus* whose morphological uniqueness allows them to be differentiated from those previously recorded for the state of Baja California and we are recognizing one as a new species within sect. *Inflati* and the other as a new variety of *Astragalus brauntonii* included within sect. *Brauntoniani*.

Materials and methods

To find out if these specimens collected in Baja California were new taxa, they were compared with the specimens stored in the herbaria of ANSM, BCMEX, CAS, CFNL, CIIDIR, ENCB, MEXU, NY, SD, TEX and US. As we discovered that they were not previously described in *Astragalus*, we incorporated them into our detailed analyses and compared them morphologically with taxa in previously recognized sections of this genus (Barneby 1964) and under the genus concept of Barneby (1964). Botanical material collections were made from June 5 to 7 in the surroundings of Ciudad Tijuana in areas with some anthropogenic disturbance, with chaparral vegetation, low slope and clay soils. The measurements were made on boiled flowers. The maps were made with the QGis desktop software, ver. 3.24.2. The dehydrated material was examined using a Carl Zeiss StemiDV4 stereo microscope at 320X magnification. The category status for both taxa were set based on the extent of occurrences (EOO) the area of occupancy (AOO), and the GeoCAT algorithm (Bachman *et al.* 2011). Based on the comparison of all the morphological characteristics of *Astragalus brauntonii*, both proposed infraspecific taxa present similarities in almost all of them, with the exception of the size of the peduncles, number of flowers per inflorescence, and the width of the banner and wings. Thus, we propose the recognition of a new variety for this species.

Taxonomy

Astragalus tijuanensis A. E. Estrada, Rebman, C. González & Villarreal, *sp. nov.* (Fig. 1 and Fig. 2)

Morphologically similar to *Astragalus palmeri* A. Gray, but differing in type and stipule size, number of flowers per raceme, petal colors, curvature and size of the banner, number of ovules, and diameter of the pod and the absence of pubescence.

Type:—MEXICO. Baja California (Municipio Tijuana): along Boulevard 2000 between Rosarito and Tijuana, in the vicinity of the south side of the metropolitan area of the city of Tijuana, 32° 20’11.04” N, 116°57’44.593” W, alt. 171 m, 5 June 2022, *C. González 104* (Holotype SD!; isotype MEXU!).

Herbaceous, caulescent, perennial with deep single buried root, without superficial crown of a woody taproot, 13 × 0.7 cm long. **Stems** three to several, up to 30 cm long, 3–7.5 mm diameter, erect, arising from the base, the lower part of the stems, 7–10 cm, gray color, with stipules and lower leaves persistent, the leaves dried throughout, without leaflets, the upper part of the stem green, striate, minutely and densely strigulose, the trichomes 0.1–0.3 mm long,

appressed, white. **Stipules** free or semi–amplexicaul, clasping ¼ to ½ of the stem´s circumference, 2–3 × 3–4 mm, persistent, almost always wider than longer, triangular to triangular–ovate, white to light brown, sparsely strigulose or glabrate, with only few trichomes on the edges. **Leaves** odd–pinnate, 4.5–8.5 cm long, petiole (3–)11–12(–17) mm long, leaflets (17)21–29(33) per leaf, opposite, rarely some of them alternate, (2–)8–10 × 0.7–1 mm, linear to linear–oblong, petiolule 0.2 mm long, separated from each other by 3–4 mm, glabrate and light–green adaxially, and dark–green and sparsely strigulose abaxially as stem pubescence, flattened or slightly concave, acute at both ends. **Inflorescences** in axillary open racemes, 4.5–5 cm long, peduncles erect or incurved–ascending, when young (in flower stage), 2–3 cm long, elongating with age (5–)7–11(–14) cm long (in fruit), exceeding the length of the leaves, sparsely strigulose, 0.1–0.2 mm long, the trichomes white; floriferous axis 1.5–2 cm long, elongating 2.2–5 cm long in fruit, with 13–19 flowers per raceme. **Bracts** 0.6–1.2 × 0.7–1 mm long, ovate to triangular, white to green, opaque to somewhat translucent, sometimes with slight purple tones in the upper half, subglabrate to sparsely strigulose, sometimes the midvein is evident, pedicel ascending or spreading, arched outward, 1–1.3 mm long, slightly thickened in fruit, caducous; bracteoles absent. **Flowers** 12–13 mm long, calyx (3.5–)3.9–4(–4.2) × 2.5–2.7 mm, campanulate to wide–campanulate, the tube 3.2–3.3 mm long, inequilaterous or slightly oblique sparsely strigulose, the trichomes white and purple mixed, occasionally subglabrous with few trichomes, the teeth 0.7–0.9 mm long, triangular to triangular–subulate, separated by obtuse or rounded sinuses; petals white with purple tones, the banner sessile, 12.5–13 × 6.3–7 mm, obovate, elliptic obovate to obovate–rhombic, gradually attenuated at the base, the notch 0.4–0.5 mm deep, folded at the middle, its margins then folded backward, slightly bent backward from the keel, recurved through 25°–30° from the vertical; wings 11.9–12.2 × 2–2.3 mm, the claw 5–5.2 mm long, the blade 6.8–7 mm long, straight, narrowly obliquely oblong–obovate, rounded to truncate at apex, basally auriculate; keel 9.4–9.8 × 2.5–2.8 mm, the claw 4.8–5 mm long, the blade 4.6–5 mm long, half obovate, incurved, apex rounded, auriculate; Stamens 10–merous, diadelphous, 9 fused by their filaments into a white striped sheath 5–5.2 mm long, the free part 4–4.3 mm long, enfolding the ovary, the vexilar stamen 8.6–9.3 mm long, standing free; anthers yellow, round, 0.9–1 × 0.2 mm. **Ovary** unilocular, 32–38 ovulate, sessile, linear–oblong, green, glabrous, 4.2–4.8 × 0.8 mm, the style linear, glabrous, style 4–4.5 mm long, glabrate, incurved, stigma terminal, minute, glabrous. **Pod** spreading or slightly ascending, sessile, (17–)19–20(–24) × 6–8 mm, incurved, semi–lunate in profile, at first subcylindrical to elliptic, sub–fleshy, acute in both ends, and at maturity strongly compressed laterally or low convex on the lateral faces, somewhat plump (not inflated like a bladder), ventral suture concave, keeled, dorsal suture almost straight to low convex, base acute, apiculate and rigid at the apex, the beak 0.7–1 mm long, with the sub–persistent style, the valves coriaceous, stramineous, brown to light–brown, glabrous, noticeably transversely reticulate and wrinkled, unilocular, septum absent; dehiscence apical; seeds 1.9–2.2 mm long, mitten–shaped, black, opaque.

Distribution and habitat:—As far as we know, *Astragalus tijuanensis* is only known from the type locality on the south side of the metropolitan area of Tijuana, Baja California to the east of Rosarito (Fig. 3). This species was found in a recently burned, disturbed, chaparral area on open gravelly or clayish hillsides, low slopes or flats, on clayish substrate associated with *Malosma laurina* Engl. (1883: 339)*, Xylococcus bicolor* Nutt. (1842: 259)*, Malacothamnus fasciculatus* Greene (1906: 208)*, Adenostoma fasciculatum* Hook. & Arn. (1832: 139)*, Deinandra fasciculata* Greene (1897: 424)*, Deinandra conjugens* (D.D. Keck) B.G.Baldwin (1999: 468)*, Heteromeles arbutifolia* (Lindl.) M. Roem. (1847: 105)*, Nolina interrata* Gentry (1946: 181)*, Gutierrezia californica (*DC.) Torr. & A.Gray (1842: 193)*, Eriogonum fasciculatum* var. *foliolosum* S. Stokes (1910: 351)*, Ceanothus verrucosus* Nutt (1838: 267-268)*, Adolphia californica* S. Watson (1876: 126) , and *Nicotiana glauca* Graham (1828: 2837).

Etymology:—The name of this new species refers to the type locality in the municipality of Tijuana, and to date, it is the only place known where this species grows in a small population.

Phenology:—According to the presence of reproductive structures on the type specimen, flowering likely started in early May and was continuing in early June while fruiting probably started in early June and will likely continue until the end of July or early August.

Conservation status:—This new species was discovered while surveying and documenting populations of a cross-border rare plant species called *Deinandra conjugens* as part of a binational collaborative project. This new taxon was only encountered in a single population at the type locality. Even though we documented other regional populations of *Deinandra conjugens* in the area, this new *Astragalus* was not found elsewhere. The only known population is found within the Tijuana metropolitan area, which is being strongly affected by human activity (personal observation). According to GeoCAT, the extent of its distribution and the number of occurrences, as recommended by the IUCN Red List guidelines (IUCN 2017), *Astragalus tijuanensis* should be placed in the Critically Endangered (CR) category, criteria B2ab(iii). Under the current conditions of impact due to fires, the presence of livestock, and the development of human settlements in the area of distribution of this new species, it faces a high risk of extinction.

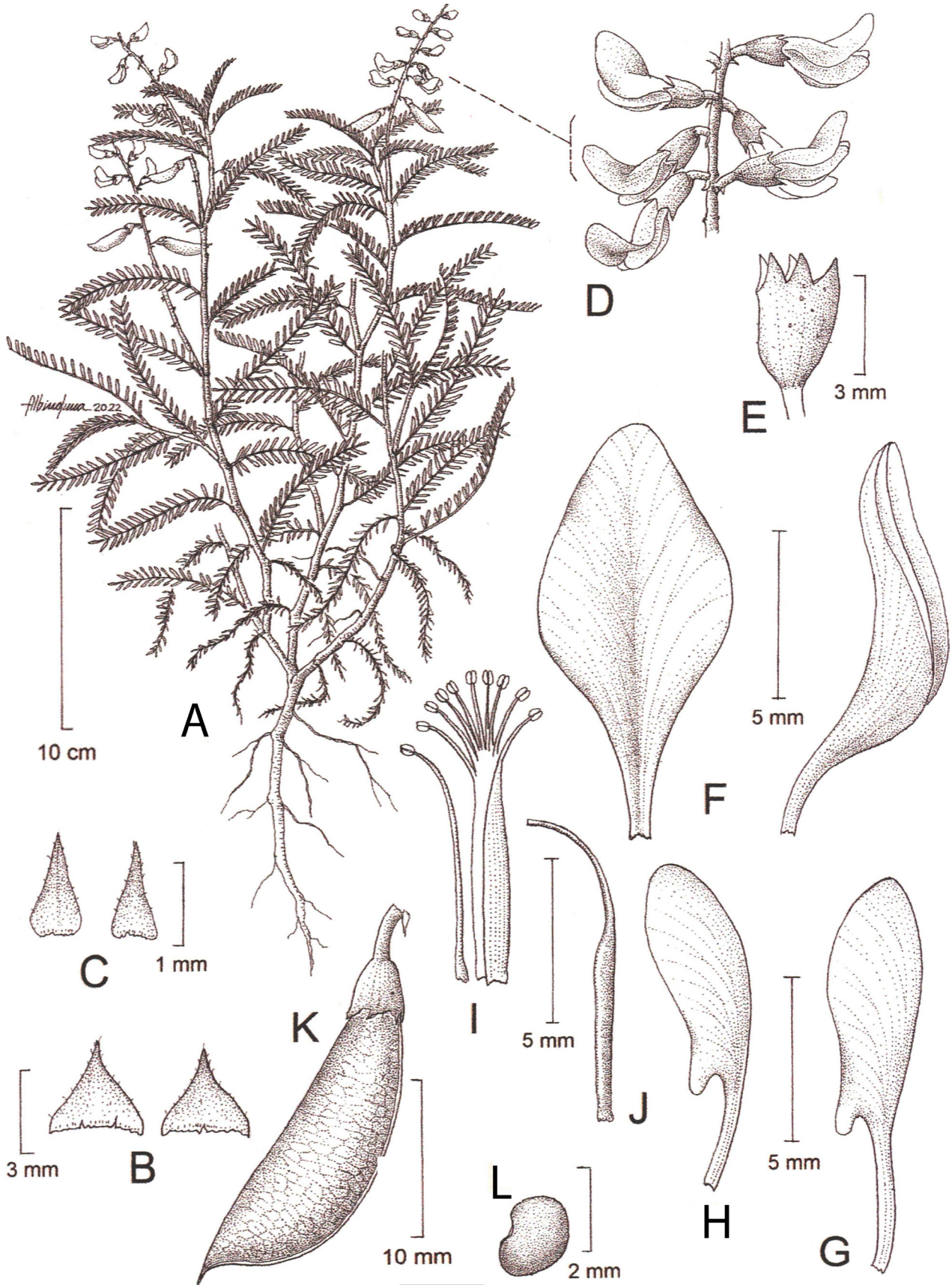

FIGURE 1. *Astragalus tijuanensis*, A) Whole plant showing leaves, inflorescences, flowers and fruits. B) Stipules. C) Bracts. D) inflorescence enlarged to see detail of the flowers. E) Calyx. F) Banner: front view (left) and side view (right). G) Wing. H) Keel. I) Stamens. J) Ovary. K) Fruit. L) Seed.

FIGURE 2. *Astragalus tijuanensis*, part of the plant showing its leaves, inflorescences, flowers, and fruits.

FIGURE 3 . Map showing the distribution of *Astragalus tijuanensis* (white star) and *A. brauntonii* var. *lativexillum* (black dot) in Tijuana, Baja California, Mexico.

Astragalus brauntonii Parish **var. *lativexillum*** A. E. Estrada, Rebman, C. González & Villarreal, var. nov. (Fig. 4 and Fig. 5)

Morphologically similar to *Astragalus brauntonii* Parish var. *brauntonii*, differing from this new variety by its shorter peduncles, fewer flowers per inflorescence, and narrower banner and wings.

Type:—MEXICO. Baja California (Municipio Tijuana): along Boulevard 2000 between Rosarito and Tijuana, in the vicinity of the south side of the metropolitan area of the city of Tijuana, 32°20’11.008” N, 116°57’43.236” W, alt. 176 m, 7 June 2022, *C. González 106* (Holotype MEXU!; isotype SD!).

Herbaceous, caulescent, perennial with taproot. **Stems** several, hardened at base, straight, fistulated a little higher and striate, erect or ascending, up to 1.5 m tall, densely pubescent, villose to tomentulose, the trichomes, 1–1.7 mm long, entangled, white, wavy. **Stipules** 2.8–8 mm long, subulate to linear, abruptly widened at base, amplexicaul, decurrent, dorsally pubescent, embracing up to a half the circumference of the stem. **Leaves** gradually decreasing in size from base to apex, 5–15 cm long, leaflets 20–33 per leaf, 3–20 mm long, ovate, narrow elliptic to elliptic–obovate, acute to obtuse at apex, greenish to canescent, somewhat folded or flat, carinate adaxially by the midrib. **Inflorescence**, single or several at the top of the stems, the peduncles closely spaced, 0.7–1.5 cm, always shorter than leaf, peduncle up to 2 cm long, straight and erect, spreading to incurved, pubescent as stem, the floriferous axis up to 2 cm long in fruit, flowers 25 or less per raceme. **Bracts** 2.5–5.1 mm long, lanceolate, acuminate, straight to deflexed, densely villose–tomentose; pedicels ascending arched outward, 0.5–0.7 mm long; bracteoles absent. **Flowers** purple to pink–purple, dull, the calyx campanulate, 6.1–8.1 × 3–3.8 mm, the tube 3–4.1 mm long, the teeth 2.4–6 mm long, membranous or papery, villous with white trichomes or with white, black and darker colored fuscous ones mixed, or only with ones in the tube and fuscous ones at the teeth; the banner 9–12 × 6.9–7.5 mm, subentire to shallowly retuse, obovate, the wings 8.2–10.2 × 2–2.3 mm, elliptic–obovate, the claw 3.2–4.6 mm long, the blade 5.5–6.6. mm long, slightly incurved apically, narrow oblong–oblanceolate, auriculate basally; the keel 6.3–8.5 × 2.2–2.5 mm, the claw 3.3–4.3 mm long, the blade 3.7–4.5 mm, semi–obovate, incurved, apex rounded, auriculate; stamens 10–merous, diadelphous, 9 fused by their filaments into a white striped sheath 5–5.5 mm long, the free part 2.5–2.8 mm long, enfolding the ovary, the vexilar stamen 8.1–8.5 mm long, standing free; anthers yellow, elliptic, 0.6–7 mm long. **Ovary** unilocular, 6–9 ovulate, sessile, oblong, green, densely villous, 3–3.2 × 1 mm, the style linear, glabrous, style 6–6.5 mm long, pubescent at 2–3 mm of its base, then glabrate, incurved, stigma terminal, minute, glabrous, orange. **Pod** deflexed, 6.4–9 × 2.5–4 mm, caducous, sessile or upon a thin gynophore 0.7 mm long or shorter, the body oblong to ovate–oblong, plump, obtuse to cordate at base, apically acute in a incurved to subulate 1–1.5 mm long beak, openly triquetrous, ventrally keeled by the suture, the dorsal suture deeply grooved, the lateral faces widely rounded, the valves green, light–brown to

stramineous, thinly fleshy, somewhat coriaceous to stiffly papery, villous to tomentose, with perpendicular reticulation below pubescence; septum 1–1.3 mm wide; seeds 1.2–2.2 mm long, brown to dark–brown, shallow wrinkled.

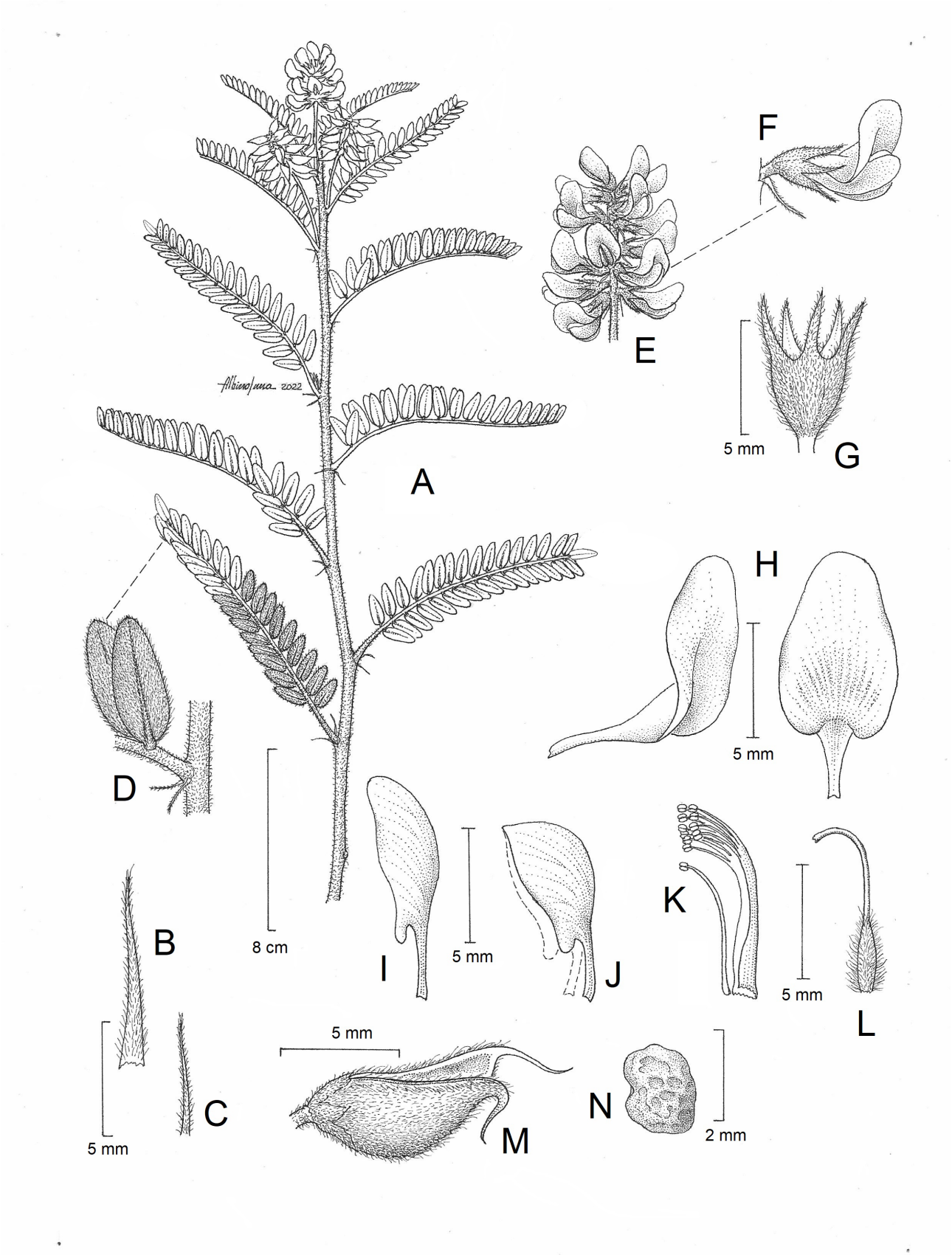

FIGURE 4. *Astragalus brauntonii* var. *lativexillum*, A) Whole plant showing leaves, inflorescences, flowers and fruits. B) Stipule. C) Bract. D) leaflets showing the dense pubescence. E) inflorescence enlarged to see detail of the flowers. F) Flower. G) Calyx. H) Banner side view (left) and front view (right). I) Wing. J) Keel. K) Stamens. L) Ovary. M) Fruit. N) Seed.

FIGURE 5. *A. brauntonii* var. *lativexillum* part of the plant showing its leaves, inflorescences, and flowers.

Dichotomous key to identify the varieties of *Astragalus brauntonii*

1. Peduncles 2.4 cm long or shorter; flowers 30 or less per raceme; banner 6.9–7.5 mm wide; wings 3 mm wide; Tijuana, Mexico ..... *A. brauntonii* var. *lativexillum*
– Peduncles 2.5–9 cm long; flowers 35–60 per raceme; banner 4.5–5.5 mm wide; wings 2–2.3 mm wide; Los Angeles and surrounding areas, USA ..... *A. brauntonii* var. *brauntonii*

Distribution and habitat:—This is the first report of *Astragalus brauntonii* for Mexico, but it is represented as a new variety for this species. This new variety of *A. brauntonii* is separated approximately 240 km further south from the populations of this species present in Los Angeles County and adjacent counties in California. This new variety is only known from the type locality and two other populations in the area documented with inaturalist inaturalist.org/observations/120360892; inaturalist.org/observations/132226913) observations, at the southern edge of the city of Tijuana, Baja California (Fig. 2), and it is coexisting with *A. tijuanensis* at the type locality. Both of these taxa are present in recently burned, disturbed, chaparral habitats on open gravelly or clayish hillsides, low slopes or flats, on clayish substrate.

Etymology:—The name of this new variety refers to the much wider banner petal of the flower for the new variety as compared to var. *brauntonii*.

Phenology:—According to the presence of reproductive structures on the type specimen, flowering likely occurred near the middle of May to early June and fruiting appears to be from early June to possibly early August.

Conservation status:—This new variety was discovered while surveying and documenting populations of a cross-border rare plant species called *Deinandra conjugens* as part of a binational collaborative project. This new taxon was only encountered in a single population at the type locality. Even though we documented other regional populations of *Deinandra conjugens* in the area, this new *Astragalus* was not found elsewhere. Furthermore, the populations and habitats for these new, rare taxa are within the Tijuana metropolitan area and this region is being strongly affected by human activity (personal observation). Thus, according to the GeoCAT, the extent of occurrences and the area of occupancy, which in this case is less than 1 km^2 and the default cell width of much less than 1 km, as recommended by the IUCN Red list guidelines (IUCN 2017), *A. brauntonii* var. *lativexillum* should be placed in the category of critically endangered (CR), criterion B2ab (iii). Under the current conditions, Under current fire conditions, livestock impact and human settlement development that are being carried out in the area of distribution for these taxa, both new *Astragalus* taxa are facing a high risk of extinction. It is essential to continue botanical explorations in this region and adjacent areas in order to know if these new taxa are more widely distributed than currently known and to let the people of the region know of their existence, importance and promote their protection.

Discussion:—Most of the species of the sect. *Inflati* in Mexico are found in the Baja California region, and are easily distinguished from the rest of the other sections by their free stipules, relatively small flowers and unilocular, globose, obliquely–oblong, bladdery inflated or swollen, papery or slightly rigid, sessile and deciduous pod, and almost always the absence of the septum within the fruit. Morphologically, *A. tijuanensis* presents certain similarities with species from this section such as *A. palmeri* A. Gray (1868: 398) and *A. deanei* (Rydb.) Barneby (1958: 133), but also physiognomically, it is somewhat similar to to *A. pachypus* Greene (1885: 157) (sect. *Pachypodes* (Jones) Barneby (1964: 487)) and *A. deanei* (sect.*Inflati*) (Table 1). *Astragalus palmeri, A. deanei,* and *A. pachypus* are distributed in the southern part of the state of California, USA, but only *A. palmeri* crosses the geopolitical border into Mexico and extends its distribution to almost the entire length of the state of Baja California. *Astragalus tijuanensis* and *A. palmeri* both occur in northern Baja California and are distributed in the regional arid ecosystems, sometimes in similar plant associations, but do not have sympatric ranges. Both species share several morphological characters in common, but certain easily distinguishable features are useful to discriminate them from each other. The most evident characters of *A. tijuanensis* are its thinly 0.1–0.3 mm long sparsely–strigulose pubescence on stems and leaves; greater number of leaflets per leaf (on average 21–29); leaflets up to 10 mm long, glabrate adaxially; 13–19 flowers per inflorescence; calyx teeth 0.7–0.9 mm long, and the banner 12.5–13 mm long. *Astragalus tijuanensis* has glabrous pods, and larger and fewer flowers per raceme than *A. palmeri*. The flowers of *A. tijuanensis* are white with purple tones, while in *A. palmeri*, the flowers are pink or pink–purple. *Astragalus deanei* is easily distinguished from *A. tijuanensis* by its white to ochroleucous flowers, much larger penduncles and racemes, and larger calyx and calyx teeth size, while *A. pachypus* has lemon–yellow or white flowers and a stipitate pod (Table 1). It is interesting to note that the presence of *Astragalus brauntonii* is rare in Mexico, despite its relatively large size and its large and obvious foliage, easy to see in the field, growing in sites with some kind of disturbance in both, Mexico and USA. The short peduncles (2.4 cm long or shorter) and the abundant, small (6.1–8.1 mm long) and reflexed flowers, as well as the small reflexed semi–ovoid fruits with rigid valves of *Astragalus brauntonii* show a certain resemblance to that of *Astragalus clevelandii* Greene (1882: 121), sect. *Micranthi* A. Gray (1864: 198) from the Coastal Ranges of northern California, but this new variety differs in having larger peduncles (10–30 cm long) and smaller flowers (5–6 mm long) than the latter species. The same characteristics of small flowers, long peduncles, and small, reflexed, ovoid, rigid and internally bilocular fruits are also shared with certain Mexican species of the sect. *Micranthi* A. Gray (1864: 198), but these are easily discernible by the presence of connate stipules.

TABLE 1. Morphologic characters of *Astragalus tijuanensis*, *A. palmeri, A. deanei* and *A. pachypus.* The words in bold highlight the main morphological characters for differences between *Astragalus tijuanensis* and the other species.

CHARACTER	*Astragalus tijuanensis*	*Astragalus palmeri*	*Astragalus deanei*	*Astragalus pachypus*
Root	Buried, not from a superficial crown	Annual to potentially perennial	Buried, not from a superficial crown	Superficial crown of a woody taproot
Habit	Herbaceous, perennial, erect or ascending, brached from the base. straight	Herbaceous, annual to perennial, prostrate or weakely ascending	Perennial, tall and coarse	Robust, erect, rigid, flexuous and abruply in zigzag distally
Stems size/ pubescence	30–35 cm long/simple, strigulose, trichomes 0.1–0.3 mm long	Up to 50 cm/simple, densely canescent, trichomes 0.35–6 mm long	30–60 cm long/glabrous	15–80 cm long/simple, filiform to scale like hairs, 0.4–0.7 mm long
Stipules type/shape/ size	Free or semi–amplexicaul/ triangular–ovate/2–3 mm long, wider than long	Semi–amplexicaul /triangular to deltoid acuminate/1.5–6.5 mm long	Decurrent/deltoid to broadly triangular–acuminate/2–7.5 mm long	Semi–amplexicaul/deltoid/1.5–5.5 mm long
Stipule pubescence	Sparsely strigulose dorsally, margins with simple trichomes (ciliate)	Glabrous to pubescent dorsally, the margins ciliate, freuently beset with a few minute processes	Glabrous dorsally	Pubescent or glabrate, margins with clavate processes
Leaves size	4.5–8.5 cm long	2–16 cm long	8–18 cm long	(2.5)5–15(–16.5) cm long
Leaflets number per leaf	(17)21–29(33)	9–21	19–29	11–27
Leaflets size	(2–)8–10 mm long	3–25 mm long	4–21 mm long	(3–)5–25(–34) mm long
Leaflets pubescence	Glabrate and light–green adaxially, and dark–green and sparsely strigulose abaxially	Mostly pubescent on both sides, more densely so adaxially than abaxially, rarely glabrous	Glabrate, except by midribwith few scatered trichomes 0.3–0.5 mm long	Very sensely strigulose, silvery–white adaxially, more thinly pubescent abaxially
Inflorescence size	4.5–19 cm long	Up to 29 cm long	Up to 35 cm long	Up to 33 cm long
Peduncles size in flower	**2–3 cm long**	4–13 cm long	6 cm or longer	Up to 20 cm long
Peduncle size in fruit	(5–)7–11(–14) cm	Up to 13 cm long	Up to 20 cm long	5–20 cm long
Raceme size in flower	**1.5–2 cm long**	3.5–21 cm long	5 cm or longer	2 cm long or longer
Raceme size in fruit	**2.2–5 cm long**	Up to 21 cm long	Up to 16 cm long	2–13 cm long
Flowers per raceme	13–19	20–40	13–25	(4)5–20(28)
Floweres color	White and purple	Pink–purple	Whitish, drying ochroleucous	White, sometimes with pink or lavender tones, or lemon–yellow
Bracts size	0.6–1.2 x 0.7–1 mm long	0.8–2.6 mm long	1.5–2.5 mm long	0.7–2.5 mm long
Bracteoles	0	0–2	0–2	0–2
Calyx size	(3.5–)3.9–4(–4.2) mm	3.6–6.6 mm long	4.7–7.2 mm long	5.5–9.5 mm long
Calyx tube size/wide	3.2–3.3 x 2.5–2.7 mm	(2.2) 2.7–3.8 x 1.8–3.4 mm	2.7–4.5 x 2.5–3.8 mm	3.6–5.2 x 3.6–5 mm
Calyx teeth size	**0.7–0.9 mm long**	0.9–2.8 mm long	1.8–2.7 mm long	1.5–4.3 mm long
Calyx color	Green mixed with purple	Green–light to purple	Purple	Green
Calyx pubescence	Sparsely strigulose, trichomes white and purple,	Strigulose with all trichomes black, all trichomes white, or both color together, mixed	Thinly strigulose, with all white hairs or mixed black and white	Strigulose with black and white trichomes, rarelly all white.
Banner size	12.5–13 x 6.3–7 mm	7–10.3 x 5.2–8 mm	9.5–15.2 mm long	15–22 x 7–14.5 mm

.....continued on the next page

TABLE 1. (Continued)

CHARACTER	*Astragalus tijuanensis*	*Astragalus palmeri*	*Astragalus deanei*	*Astragalus pachypus*
Banner bent	Nearly 45°	Nearly 90°	45°	45°
Banner shape	Obovate, elliptic obovate to obovate–rhombic	Obovate–cuneate	Broadly-rhombic to rhombic–ovate	Broadly rhombic–ovate or rhombic elliptic
Wings size	11.9–12.2 mm long	6.7–9.2 mm long	(8.7)–13.2 mm long	14–18 mm long
Wing wide	2.3 mm	1.7–3 mm	2.1–3.6 mm	2.7–3.1 mm
Wing claw size	5–5.2 mm long	2.5–3.7 mm long	3.2–4.5 mm long	5–7 mm long
Wing blade size	6.8–7 mm long	4.4–6.2 mm long	6–8.8 mm long	7.2–13 mm long
Keel size	9.4–9.8 mm long	6.2–8.8 mm long	8.4–10.5 mm long	10.7–15.3 mm long
Keel wide	2.5–2.8 mm	2–2.6 mm	2.3–3.2 mm	2.7–4.2 mm
Keel claw size	4.8–5 mm long	2.5–3.7 mm long	3.4–5 mm long	4.9–7.1 mm long
Keel blade size	4.6–5 mm long	4.1–5.5 mm	4.8–6.2 mm long	6.7–10.3 mm long
Ovules number	32–38	7–31	29–40	20–36
Pod size	(17–)19–20(–24) mm long	9–23 mm long	15–28 mm long	12–28 mm long
Pod locules	1	1	1	2, below beak
Pod wide	6–8 mm	4–17 mm	8–18 mm	4–7.5 mm
Pod shape	Semi–lunate in profile, compressed laterally, but somewhat plumpy (not inflated like a bladder), keeled ventrally and dorsally by the concave and covex suture respectivelly	Obliquely ovoid–elliptic or ovoid–acuminate, moderately to strongly inflated, little dorsiventrally or laterally compressed, its lateral faces plumply rounded	Bladdery inflated or laterally compresed, openly grooved in the ventral suture	Straight, horizontally spreading or ascending, the body lunately or falcately oblong–cylindric
Pod position with respect to receptacle	Sessile	Sessile	Sessile	Stipitate, stipe 4–8 mm long
Pod valves	Coriaceous, noticeably reticulate	Papery	Papery	Stiffly leathery or subligneous
Pod pubescence	Glabrous	Densely strigulose	Thinly strigulose	Glabrous
Septum	Absent	Absent	When present, not above 0.4 mm wide	2.7–6 mm wide
Seeds size	1.9–2.2 mm long	2–3 mm long	2.1–2.5 mm long	3.1–4.6 mm long
Seed color	Black, opaque	Orange or mahogany–brown	Brown to greenish–brown, dull	Brown, greenish brown and purple dotted, rarley blackish purple

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References

Bachman, S., Moat, J., Hill, A.W., de la Torre, J. & Scott, B. (2011) Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool, Version BETA. e–Infrastructures for data publishing in biodiversity science. *ZooKeys* 150: 117–126. https://doi.org/10.3897/zookeys.150.2109

Baldwin, B.G. (1999) New combinations and new genera in the North American tarweeds (Compositae: Madiinae). *Novon* 9 (4): 468. https://doi.org/10.2307/3392143

Barneby, R.C. (1958) *Astragalus deanei*, *Aliso* 4: 133. https://doi.org/10.5642/aliso.19580401.11

Barneby, R.C. (1964) Atlas of North American *Astragalus*. *Memoirs of the New York Botanical Garden* 13: 1–1188.

Barneby, R.C. (1989) *Intermountain Flora (Fabales)*. Vol. 3, Part B. The New York Botanical Garden, 279 pp. https://doi.org/10.2307/20179569

Englemann, G. (1883) *Malosma laurina. Monogr. Phan.* [A.DC. & C.DC.] 4: 393.

Estrada, E., Rebman, J.P. & Villarreal, J.A. (2019) *Astragalus comonduensis* and *Calliandra pilocarpa* (Fabaceae), two new species from Baja California Sur, Mexico. *Phytotaxa* 391 (1): 57–68. https://doi.org/10.11646/phytotaxa.391.1.4

Estrada, E., Villarreal, J.A. & Encina, J.A. (2020) A new species and a new section of *Astragalus* (Fabaceae: Papilionoideae) from Mexico. *Phytotaxa* 428 (3): 163–172. https://doi.org/10.11646/phytotaxa.428.3.1

Estrada, E., Villarreal, J.A. & Delgado-Salinas, A. (2022) A new section of *Astragalus* (Fabaceae: Galegeae) from Mexico. *Phytotaxa* 545 (1): 79–86. https://doi.org/10.11646/phytotaxa.545.1.6

Gentry, H.S. (1946) A new *Nolina* from southern California. *Madroño* 8: 181, fig. 1, tab. 19.

Graham, R. (1828) Description of new and rare plants. *The Edinburgh new philosophical journal* 55: t. 175.

Gray, A. (1864) Revision and arrangement (mainly by the fruit) of the North American species of *Astragalus* and *Oxytropis*. *Proceedings of the American Academy of Arts and Sciences* 6: 188–236.

Gray, A. (1868) *Astragalus palmeri. Proceedings of the American Academy of Arts and Sciences* 7: 398.

Greene, E.L. (1882) *Astragalus clevelandii. Bulletin of the Torrey Botanical Club* 9: 121. https://doi.org/10.2307/2476026

Greene, E.L. (1885) *Astragalus pachypus. Bulletin of the California Academy of Sciences* 1: 157.

Greene, E.L. (1897) *Deinandra fasciculata* Greene. *In: Flora Franciscana: An Attempt to Classify and Describe the Vascular Plants of Middle California.* pp. 424.

Greene, E.L. (1906) *Malacothamnus fasciculatus*. *Leaflets of Botanical Observation and Criticism* 1: 208

Hooker, J.D. & Arnot, D. (1832) *Adenostoma fasciculatum*. *In: The Botany of Captain Beechey's Voyage.* pp. 139.

Inaturalist. (2022) Available from: https://forum.inaturalist.org/t/citing-inaturalist-data/8684 (accessed 31 August 2022).

IUCN. (2017) Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petition subcommittee. Available from: http://cmsdocs.s3.amazonaws.com/ RedListGuidelines.pdf (accessed June 2022)

Linnaeus, C. (1753) *Astragalus*. *Genera Plantarum* 2: 755.

Lnag-rang, X. & Podlech, D. (2010) *Astragalus* Linnaeus. *In*: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (eds.) *Flora of China* 10. Science Press, Beijing and *Missouri Botanical Garden Press*, St. Louis. U.S.A. 642 pp. [pp. 328–453.]

Lock, J.M. & Simpson, K. (1991) *Legumes of West Asia: A Check-list.* Royal Botanic Gardens, Kew.

Lock, M. & Schrire, B. (2005) Tribe Galegeae. *In:* Lewis, G., Schrire, B., Mackinder, B. & Lock, M. (eds.) *Legumes of the world.* Kew: Royal Botanic Gardens. pp. 475–487.

Nuttall, T. (1838) *Ceanothus verrucosus*. *Flora of North America* (Torr. & A. Gray) 1 (2): 267–268.

Nuttall, T. (1842) *Xylococcus bicolor*. *Transactions of the American Philosophical Society, ser. 2*, 8: 259.

Parish, S.B. (1903) *Astragalus brauntonii*. *Bulletin of the Southern California Academy of Sciences* 2: 26.

Rebman, J.P., Gibson, J. & Rich, K. (2016) Annotated checklist of the vascular plants of Baja California, Mexico. *Proceedings of the San Diego Society of Natural History* 45: 1–352.

Roemer, M.J. (1847) *Heteromeles arbutifolia*. *Familiarum Naturalium Regni Vegetabilis Synopses Monographicae seu Enumeratio Omnium Plantarum hucusque Detectarum Secundum Ordines Naturales, Genera et Sepcies Digestarum, Additas Diagnosibus, Synonymis, Novarumque vel Minus Cognitarum Descriptionibus Curante M. J. Roemer.* 3: 105.

Stokes, S. (1910) *Eriogonum fasciculatum* var. *foliolosum*. *Bulletin of the New York Botanical Garden* 6: 351.

Torrey, J. & Gray, A. (1842) *Gutierrezia californica*. *A Flora of North America* 2 (2): 193.

Watson, S. (1876) Description of new speciesof plants, chiefly Californian, with revisoon of certain genera. *Proceedings of the American Academy of Arts and Sciences* 11: 126.
https://doi.org/10.2307/20021459

Wiggins, I.L. (1980) *Flora of Baja California*. Stanford University Press, Stanford, California, 1740 pp.

Zarre, S. & Azani, N. (2013) Perspectives in taxonomy and phylogeny of the genus *Astragalus* (Fabaceae): a review. *Progress in Biological Science* 3: 1–6.